

THE GENUS SEDELLA

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The genus *Sedella* of the Crassulaceae, established by Britton and Rose in 1903, has been known by only two species, both restricted to California: *Sedella pumila* (Benth.) Brit. and Rose and *Sedella Congdoni* (Eastw.) Brit. and Rose. These species were included in *Sedum* by Bentham and by Eastwood, and are so treated by Berger in his recent revision of the Crassulaceae (Die Natürlichen Pflanzenfamilien, ed. 2, 18A: 462. 1930.). Their separation from *Sedum* by Britton and Rose is on the basis of the single, erect seeds in the carpels as opposed to the many, horizontally arranged seeds in the carpels of *Sedum*. *Sedella Congdoni* has been reduced to varietal status under *S. pumila* by Jepson. In the opinion of the writer, a comparative examination of the two species substantiates the viewpoint of Eastwood and of Britton and Rose in regarding *S. Congdoni* as a specific entity. *S. pentandra*, described in this paper, adds a third species to this genus of diminutive, California annuals.

Herbarium material used in the study of this genus was obtained from the University of California Herbarium (UC), the Herbarium of the California Academy of Sciences (CA), and the Dudley Herbarium of Stanford University (SU).

KEY TO THE SPECIES

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| Stamens 5; petals erect in both flower and fruit, 2 mm. long; follicles appressed | 1. <i>S. pentandra</i> |
| Stamens 10. | |
| Petals spreading in flower, erect in fruit, 3-4 mm. long; follicles connivent | 2. <i>S. pumila</i> |
| Petals spreading in both flower and fruit, 2 mm. long; follicles spreading | 3. <i>S. Congdoni</i> |

1. *Sedella pentandra* sp. nov. Herba annua, erecta, glabra, succulenta, 3-13 cm. alta; caulis rectus, simplex, vel e nodis infimis 1-3-ramosus; rami cauli principe semper breviores; cymarum rami 2-5, virgati, pseudo-paniculati, 2-3 cm. longi; flores congesti, secundi, uno- vel biseriatii, 3 mm. longi, 2 mm. lati; hypanthium turbinatum; petala pallido viridi-lutea, lanceolata, 2 mm. longa per anthesin erecta, demum carpelii maturis adpressa; nectaria clavata petalorum basi leviter adhaerentia; stamina 5, corollae adnata, in sinu petalorum inserta; carpella 1 mm. longa, commisuris et suturis papillis glandulosis tectis; styli erecti, 0.3-0.4 mm. longi; folliculi conniventes papillis prominentibus, suturis acute carinatis; semen solitarium.

Erect, glabrous, succulent annual, 3-13 cm. tall, averaging 7 cm.; herbage reddish-green to green; root system small, spreading, fibrous, 0.5-2.0 cm. in diameter; hypocotyl 1-2 cm. long; cotyledons early deciduous; stem straight, usually unbranched

up to inflorescence or 1-3 virgate, delicate branches from lowermost nodes, but branches always shorter than main stem; cauline leaves sessile, entire, very fleshy, oblong-ovoid to elliptic-obovoid, obtuse, 4-5 or sometimes 7 mm. long, 3 mm. broad, point of attachment 1 mm. above gibbous base, lowest 2 leaves opposite, then several sub-opposite, all others alternate, closely imbricate in young plant (but internodes elongating with maturity to 2-7 mm.), caducous; inflorescence bracteate, a sympodium or spicate cyme, with 2-5 falsely paniculate, virgate branches 2-3 cm. long arising below the first and terminal flower, accessory cymes produced on the occasional lower branches; bracts of inflorescence like cauline leaves but progressively smaller toward branch tips, the smaller less obtuse or even acute, persistent through flowering stage; flowers crowded, secund in 1-2 rows, alternate, 3 mm. long, 2 mm. broad, sessile or subsessile; hypanthium turbinate, fleshy; sepals 5, fleshy, deltoid, 0.5 mm. long; petals coalesced at base, pale greenish-yellow, sometimes with a dorsal, longitudinal, red streak, lanceolate, 2 mm. long, inserted on hypanthium rim, alternate with sepals, erect or slightly spreading in anthesis, strictly erect and closely appressed to carpels in fruit, persistent; nectaries clavate, lightly adherent to base of petals; stamens 5, yellow, included, adnate to corolla in sinus of petals, anthers reniform, filaments capillary; carpels 5, free, green, approximate, 1 mm. long, back rounded and smooth or slightly glandular papillate, commissures and suture covered by glandular papillae; style capillary, 0.3-0.4 mm. long, erect; follicles 1.2-1.5 mm. long, 1-seeded, appressed, greenish-yellow to bright red, papillae prominent, suture sharply keeled; seeds erect, light brown, oblong-clavate, microscopically striate; 0.8 mm. long.

Type. Moss-covered sandstone boulder in partially sheltered recess on south side of stream bed, six miles (3.7 km.) above mouth of canyon, Arroyo del Puerto, Stanislaus County, Mount Hamilton Range of the South Coast Ranges, California, altitude 850 feet (261 m.), April 21, 1935, *C. W. and H. K. Sharsmith 1831* (UC 540617).

Range. Known only from the interior of the Mount Hamilton Range, 850-2000 feet, growing in rocky areas of slate, shale, or sandstone which usually dry out early; on canyon slopes, at edges of open chaparral, or near margins of small, intermittent streams.

Other collections from the type locality, showing different stages of growth. March 29, 1935, *C. W. and H. K. Sharsmith 1639*, immature plants (UC 540619); May 19, 1935, *C. W. and H. K. Sharsmith 3129*, plants in fruit (UC 540618). Additional collections. Santa Clara County: dry rocky slope at north edge of Santa Isabella Valley, altitude 2300 feet, April 28, 1935, *C. W. and H. K. Sharsmith 1848*; shale outcrop, south slope of Arroyo Bayo, altitude 2000 feet, May 5, 1935, *C. W. and H. K.*

Sharsmith 3063, May 19, 1935, *C. W. and H. K. Sharsmith 3160*; shale outcrop at edge of tributary to Sulphur Springs Creek, San Antonio Valley, altitude 2000 feet, May 9, 1935, *H. L. Mason*, June 8, 1935, *C. W. and H. K. Sharsmith 3271*. All collections mentioned above are deposited in the University of California Herbarium.

2. *SEDELLA PUMILA* (Benth.) Brit. and Rose, Bull. N. Y. Bot. Gard. 3: 45. 1903. *Sedum pumilum* Benth. Pl. Hartw. 310. 1849.

Erect, glabrous, succulent annual, 3–17 cm. tall, averaging 9 cm.; cotyledons ovate, sessile; main stem with several to many branches from lower nodes, branches usually stout, fastigiate to somewhat diffuse, as long as main stem; leaves sessile, entire, very fleshy, oblong-ovoid with gibbous base, obtuse, 4–7 mm. long, alternate or lower sometimes opposite, caducous; flowers crowded, sessile or subsessile, secund on the virgate branches of the bracteate, cymose inflorescence; hypanthium saucer-shaped; petals 3–4 mm. long, lanceolate, spreading in anthesis, erect in fruit, straw-colored, sometimes with faint, dorsal streak of red, lanceolate; stamens 10; carpels with a strong, fimbriate row of papillae on suture, commissures moderately papillate; style erect, 1 mm. long; follicles merely connivent, not closely approximate, 2–2.5 mm. long.

Range. Foothills of northern California, 150–2000 feet: Napa Range; western edge of Sierra Nevada from Sutter County to Merced County.

Specimens examined. Napa County: 3 miles south of Napa City, May 31, 1935, *H. L. Mason* (UC); near Yountville, May 5, 1907, *H. P. Chandler 7557* (UC, SU); Napa, April 25, 1902, *A. A. Heller* (SU); near Napa City, April 28, 1893, *W. L. Jepson* (UC); near Napa, April 25, 1902, *A. A. Heller and H. E. Brown 5360* (SU); Soda Springs, April, 1895; *C. F. Sonne* (UC). Tehama County: between Paynes Creek and Mineral on Susanville road, May 9, 1930, *Doris Gillespie 9283* (SU). Butte County: along Chico-Oroville road, 7 miles from Chico, April 19, 1926, *A. A. Heller 13923* (UC, SU), April 27, 1914, *A. A. Heller 11339* (CA, SU), *11329* (UC, SU), topotypes; Berry Canyon, May 7, 1902, *A. A. Heller and H. E. Brown 5486* (SU); foothills, March, 1897, *Mrs. C. C. Bruce 1776*. Sutter County: near Marysville Buttes, April 20, 1891, *W. L. Jepson* (UC); West Butte, Marysville Buttes, April 22, 1926, *Roxanna S. Ferris 6359* (SU). El Dorado County: between Placerville and Camino, May 25, 1907, *Katherine Brandegee* (UC). Amador County: New York Falls, 1500 feet, May 30, 1896, *George Hansen 1784* (SU). Calaveras County: 4.7 miles west of San Andreas, April 13, 1930, *John Thomas Howell 4705* (UC, CA); Table Hills near Mountain Ranch, May 18–30, 1895, *J. Burt Davy 1609* (UC, SU); near

Jenny Lind, 1300 feet, *F. E. Blaisdell* (CA). Tuolumne County: near Sonora, May, 1925, *E. A. Green* (SU); Table Mountain above Rawhide, altitude 2000 feet, April 11-16, 1919, *Roxanna S. Ferris 1497* (UC, SU). Merced County: 7.5 miles southwest of Merced on Los Banos Road, altitude 150 feet, April 11, 1929, *John Thomas Howell 4147* (UC, CA, SU). Mariposa County: Pea Ridge road, May, 1893, *J. W. Congdon* (SU); Mormon Bar, April 27, 1889, *J. W. Congdon* (SU).

3. *SEDELLA CONGDONI* (Eastw.) Brit. and Rose, Bull. N. Y. Bot. Gard. 3: 45. 1903. *Sedum Congdoni* Eastw. Proc. Calif. Acad. Sci. Ser. 3, 1: 135-136, pl. XI, figs. 6a-6b. 1898. *Sedella pumilum* var. *congdonii* Jepson, Man. Fl. Pl. Calif. 450. 1925.

Glabrous, succulent, annual 3-9 cm. tall, averaging 5 cm., diffuse and usually wider than tall; cotyledons obovate, sub-petiolate; lateral branches many, delicate, tortuous, longer than the main stem; leaves sessile, entire, very fleshy, oblong-ovoid with gibbous base, obtuse, 3-5 mm. long, alternate or lowermost sometimes opposite, caducous; flowers scattered along tortuous, lax branches of the bracteate, cymose inflorescence, not obviously secund, sub-sessile; hypanthium saucer-shaped; petals 2 mm. long, radiately spreading in both flower and fruit, bright yellow with dorsal streak of red, ovate-lanceolate; stamens 10; carpels with papillae in well-developed row on suture, commissures and back moderately papillate; style recurved, 0.5 mm. long; follicles widely divergent, 1.2-1.5 mm. long.

Range. Foothills of western edge of Sierra Nevada from El Dorado County to Tulare County, California.

Specimens examined. Mariposa County: Grant's Springs, April 9, 1898, *J. W. Congdon* (type CA, cotype SU); Pea Ridge region, April 19, 1901, *J. W. Congdon* (SU). El Dorado County: Coloma, March 26, 1927, *Alice Eastwood 14170* (CA). Amador County: Ione, 300 feet, May 12, 1896, *George Hansen 1566* (SU). Madera County: Raymond, May 9, 1925, *Alice Eastwood 12587* (CA). Fresno County: Big Sandy Creek, May, 1916, *Julia McDonald* (CA). Tulare County: Porterville, April 12, 1922, *Junee Kelley* (CA); March 29, 1935, *W. B. Richardson 95* (UC), May 13, 1935, *W. B. Richardson* (UC).

DISCUSSION

The outstanding character in *Sedella pentandra* is the presence of only five stamens, rather than ten as in *S. pumila* and *S. Congdoni*. The whorl of stamens opposite the petals is absent in *S. pentandra*. Such a fundamental and constant difference in floral pattern between *S. pentandra* and the other two species might suggest, to the non-conservative, a basis for generic distinction, since stamen number is considered to be a generic character in the Crassulaceae. Despite this and other points of distinction, there are so many characters common to the three species that

any such view-point is precluded. It seems apparent that there is close genetic relationship within the group. The complete loss of one whorl of stamens is only one change, coincident with other changes, which has led to speciation within the group.

In habit *S. Congdoni* is comparatively distinct from the other two species, though there is considerable similarity of form among all three, and depauperate or merely small plants are very like in appearance. In typical plants, however, a tortuous, diffuse, wider-than-tall aspect definitely marks *S. Congdoni*, while *S. pumila* and *S. pentandra* share a fastigate, virgately branching habit. These latter two species are usually easily distinguished, however, by size and branching, *S. pumila* being larger, more robust, and with the several to numerous lateral branches as long as the main stem, giving the plant a flat-topped aspect; in *S. pentandra* the lateral branches are either lacking or are definitely shorter than and subordinate to the main stem. There is often a suffusion of red in the stem and leaves of all three species, but in the material available for study this tendency is least evident in *S. pumila*, and most evident in *S. Congdoni*. Plants of *S. Congdoni* may have the chlorophyll almost completely obscured by red coloration. In the case of *S. pentandra*, field observations indicate this redness of herbage to be highly variable and probably correlated with the continued availability of water. Plants growing in soil which continues moist are almost pure green at anthesis; plants growing in soil which dries out early are the reddest. Further field observation of *S. pumila* and *S. Congdoni* might reveal similar variability in coloration. Seedlings of the three species, now being grown together under uniform habitat conditions, show, however, that *S. Congdoni* assumes this red coloration early in the germination process, in marked contrast to *S. pumila* and *S. pentandra*.

The inflorescence is in each case a sympodium or spicate cyme, that is, of the determinate nature so common in the Crassulaceae, with branches produced below the first and terminal flower in simulation of a racemose or indeterminate condition. The bracts do not subtend the flowers as in a true raceme, but are on the opposite side of the branch. Displacement often brings the bracts and flowers into close juxtaposition, however, and this increases the racemose aspect of the inflorescence. In both *S. pumila* and *S. pentandra*, the flowers are crowded on these falsely racemose branches, and come into bloom gradually from base to tip of the branches; in *S. Congdoni* they are more distant, and there is a tendency for flowering to occur nearly simultaneously all along the branches. These latter two characteristics, combined with the tortuous, diffuse nature of even the ultimate branches, make *S. Congdoni* distinct in inflorescence from *S. pumila* and *S. pentandra*.

The flowers are closely similar in the three species, but the petals of *S. pumila* and *S. pentandra* are erect, while those of *S. Congdoni* are radiate; the petals of *S. pumila* are one and one-half to two times longer than those of *S. Congdoni* and *S. pentandra*. These two characteristics and that of petal color (straw-yellow in *S. pumila*, bright yellow in *S. Congdoni*, greenish-yellow in *S. pentandra*) are the most obvious floral distinctions. The most fundamental, that of stamen number, has been discussed.

The petals of *S. pumila* are described as narrow by Bentham, as linear-lanceolate by Eastwood, and as linear by Britton and Rose. In the latter treatment the "linear" petals of *S. pumila* are used as the key character to distinguish the species from *S. Congdoni*. The writer is unable to find sufficient difference in shape of petals among these three species to warrant use of petal shape as a key character.

Nectaries, or so-called receptacle scales, one at the outer base of each carpel, are commonly present in the Crasulaceae, and are to be found in the three *Sedella* species, notwithstanding the statement by Britton and Rose of "scales none" for *S. pumila*. In *Sedella* these scales are lightly adherent to the base of the corolla opposite the petals, and detach with the corolla when it is removed. Such a position suggests that the scales are staminodia, rather than outgrowths of the receptacle.

The carpels are very similar in the three species, although they can be distinguished accurately by the character of the style; in *S. pumila* the style is long (1 mm.) and erect, in *S. Congdoni* it is half as long (0.5 mm.) and recurved, in *S. pentandra* it is still shorter (0.3–0.4 mm.) and erect. As to glandular papilla-

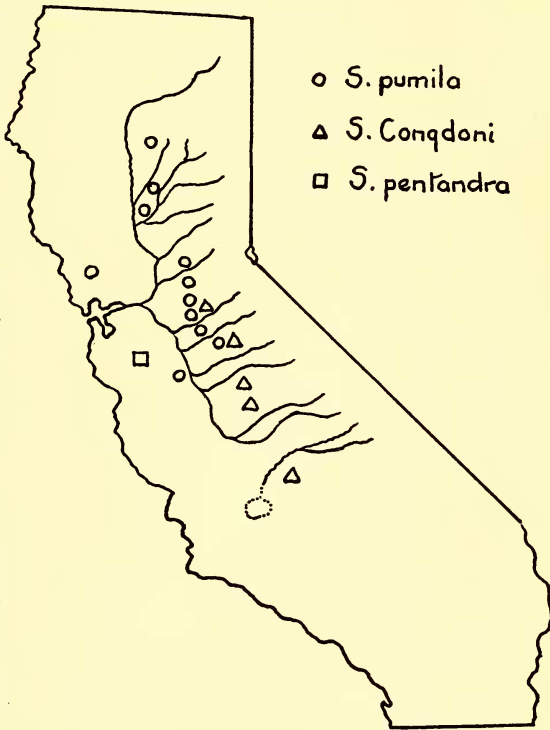


Fig. 1. Distribution of the genus *Sedella*.

tion of the carpels, there seems to be considerable variation within each species, but *S. pentandra* shows the greatest degree of glandulosity, and *S. pumila* shows the greatest development of the papillae along the suture, where they form an obvious fringe.

Early in the germination of *Sedella* seedlings it is possible to distinguish the three species. The first evidence of differentiation appears in the cotyledons and early leaves. Those of *S. pentandra* are sessile and ovoid to almost spherical, those of *S. Congdoni* are sub-petiolate and obovate, and those of *S. pumila* are sessile and ovate. From early germination on, *S. pentandra* seedlings are the smallest, *S. pumila* seedlings the largest; this size difference continues as the plants mature. The striking red coloration which appears in young seedlings of *S. Congdoni* has been mentioned. Another distinguishing character of the adult plant which evidences itself soon after germination is that of branching. *S. Congdoni* and *S. pumila* seedlings show development of lateral branches three weeks after planting. These branches arise from the axils of the lowest pair or two of leaves, and often from the cotyledonary nodes as well. At five weeks of age they are well-developed in *S. Congdoni* and *S. pumila*, but there is no trace of lateral branches in *S. pentandra* at this stage.

In habitat requirements the three species of *Sedella* are comparatively similar. All grow in the foothills or adjacent plains, in rocky places which are relatively wet in spring and very hot and usually very dry by middle summer. *S. pumila* is extreme in this regard, often growing in rocky depressions which form rain-pools in the early spring and are exceedingly dry by summer.

The genus is found only in the northern and central portion of California, restricted to the interior and eastern edges of the Coast Ranges and the western edge of the Sierra Nevada. There is little overlapping of geographic range between the species. *S. pentandra*, as now known, is the most highly restricted, and is limited to the interior and eastern side of the Mt. Hamilton Range in Santa Clara and Stanislaus counties. *S. pumila* has the widest range. It is most common in northern California, where it is known from Napa County in the North Coast Ranges, from Sutter and Butte counties in the northern Sacramento Valley, from Calaveras, El Dorado, and Tuolumne counties in the Sierra Nevada foothills, and from Merced County (a single locality) in

EXPLANATION OF THE FIGURES. PLATE XII.

- Fig. 1. *Sedella pentandra*, habit $\times 0.7$.
 Fig. 2. *Sedella pumila*, habit $\times 0.7$.
 Fig. 3. *Sedella Congdoni*, habit $\times 0.7$.
 Fig. 4. *Sedella pentandra*, single flower $\times 12$.
 Fig. 5. *Sedella pentandra*, follicle $\times 21$.
 Fig. 6. *Sedella pumila*, follicle $\times 21$.
 Fig. 7. *Sedella Congdoni*, follicle $\times 21$.

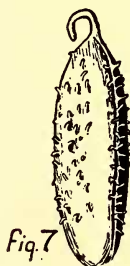
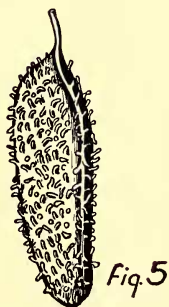
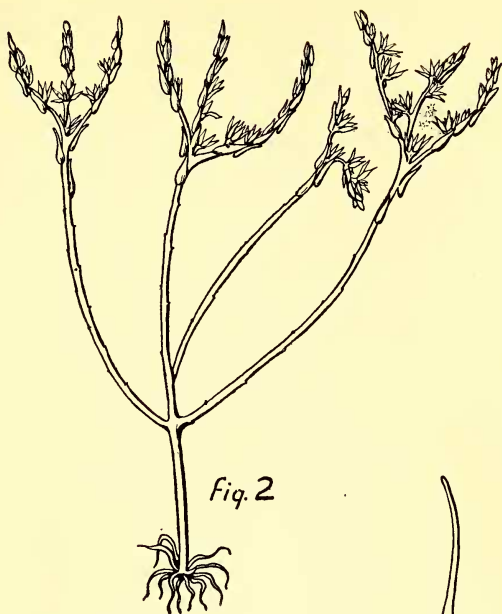


PLATE XII. THE GENUS SEDELLA.

the San Joaquin Valley. *S. Congdoni* is known from the foothills of Mariposa, Madera, Fresno, and Tulare counties, on the eastern side of the San Joaquin Valley, and from El Dorado County (a single locality) and Amador County (a single locality) on the eastern side of the Sacramento Valley.

University of California,
Berkeley, October, 1935.

STUDIES IN PENSTEMON—III

DAVID D. KECK

The Section *Cryptostemon*

A new section is required to include the recently detected species described below. No close affinities are obvious, but there is an apparent relationship between this and the section *Erianthera* Bentham. The name *Cryptostemon* calls attention to the fact that the stamens are not only included within the throat, but are hidden by the closing of the orifice of the corolla, and that the staminode is of a brevity unexcelled within the genus.

CRYPTOSTEMON Keck sect. nov.

1. PENSTEMON PERSONATUS Keck sp. nov.

Herba perennis 3–5.5 dm. alta; radicibus fibrosis numerosis; caulibus paucis erectis virgatis minute puberulis; foliis subremotis integris vel obscure obsoleteque denticulatis plus minusve glaucescentibus supra glabriusculis viridibus subtus puberulis pallidioribus ovatis vel ovato-oblongis pleraque obtusis 3–6.5 cm. longis 1.2–3.5 cm. latis, inferioribus breviter petiolatis, superioribus sessilibus, floralibus ad acuminatas bracteas vix 1 cm. longas abrupte reductis; panicula laxa 7–25 cm. longa glanduloso-pubescenti, pedunculis tenuibus divergentibus infimis ad 8 cm. longis 2–5-floris, pedicellis multum brevioribus, floribus suberectis; calyce 5–6 mm. longo, lobis ovato-lanceolatis abrupte longe acuminatis anguste scariosis; corolla personata coeruleo-violacea (?) 20–25 mm. longa extus glabra vel parce viscidula intus dense barbata, tubo superne vix dilatato apud apicem plus minusve constricto, limbo brevi, labio superiore 3.5 mm. longo, labio inferiore 5 mm. longo, lobis a marginibus revolutibus; staminibus fertilibus inclusis glaberrimis, loculis antherarum divaricatis subexplanatis 1.2–1.4 mm. longis, staminodio sigmoideo vix 4 mm. longo praesertim apice superne dense flavo-barbato; capsula ca. 6 mm. longa, ovoidea; seminibus ignotis.

Type: *John B. Leiberger 5087*, collected July 10, 1900, on a dry hillside in Flea Valley, Butte County, California, at 4500 feet (1370 meters) elevation, deposited in the United States National Herbarium, No. 610331. Another collection of this species was also made in Butte County, in dry soil near Bald Hill, elevation